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ESG Rating Divergence and Stock Price Crash Risk

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Abstract

ESG has emerged as a key non-financial indicator, drawing significant investor focus. Disparities in ESG ratings may skew investor perceptions, potentially endangering stock values and financial market stability. This paper examines the link between ESG rating divergences and stock price crash risk, drawing on data from six Chinese and global ESG rating agencies. Focusing on Shanghai and Shenzhen A-share listed firms, it analyzes information from 2015 to 2022 within the theoretical contexts of information asymmetry and external monitoring. This study finds that ESG rating divergence markedly elevates stock price crash risk, a relationship that persists through a series of robustness checks. Specifically, the mechanisms operate through two key pathways: increased reputational damage risk due to information asymmetry and reduced external monitoring due to weakened external governance. The results of the heterogeneity analysis indicate that ESG rating divergence exacerbates stock price crash risk more significantly for non-state-owned firms, firms with low levels of marketization, and firms in high-pollution industries. This study provides clear actionable strategic paths and policy intervention points for investors to avoid risks, firms to optimize management, and regulators to formulate policies.

Keywords: ESG rating divergence; stock price crash risk; reputation damage risk; external monitoring

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1. Introduction

Under the new framework of global climate governance constructed by the 29th United Nations Climate Change Conference (COP29), the International Organization for Standardization (ISO) issued the globe's first international ESG standard, ISO ESG IWA 48:2024 (ISO, 2024), in November 2024, which is a key milestone in the evolution of ESG practices from voluntary disclosure to standardized institutional frameworks. Although ESG practices have entered the stage of systemic institutionalization, the issue of ESG rating divergence has not yet been fundamentally resolved and has led to economic consequences that cannot be ignored in practical applications. ESG rating divergence is rooted in structural differences in two dimensions: First, the non-standardization of corporate ESG disclosure, specifically, against the backdrop of rising stakeholder attention to ESG issues, corporate management may strategically impair disclosure quality driven by self-interested motives to satisfy investor demands for ESG (Huang & Zhou, 2012). This will exacerbate non-standardization, making it difficult for market participants to obtain comparable high-quality ESG data; second, heterogeneity in ESG assessment criteria among rating agencies, specifically, as information intermediaries, ESG rating agencies exhibit

significant heterogeneity in their assessment frameworks, which leads to systematic differences in evaluating the same enterprise's ESG performance, thereby directly resulting in ESG rating divergence—for example, different weighting settings for ESG can lead to significant differences in share price performance (Muck & Schmidl, 2024). The existence of ESG rating divergence may produce a series of diverse economic consequences: Existing studies have shown that ESG rating divergence may exacerbate information asymmetry, increase market risk perception, raise market premium, and inhibit investment activity (Avramov et al., 2022), thereby ultimately constraining the allocative efficiency of the capital market. The latest research puts forward the "information effect" hypothesis of ESG rating divergence, which suggests that ESG rating divergence can stimulate investors' proactive information-seeking behavior, prompting them to actively intensify their information search and analysis activities, thereby reducing decision-making bias and mitigating stock price crash risk (Shao et al., 2025).

The generation mechanism of stock price crash risk can be divided into dual internal and external drivers: the endogenous root cause is management's tendency to manipulate information disclosure, and the exogenous trigger is the opacity of institutional information environment (Quan et al., 2016), which together lead to the emergence of management's opportunistic behaviors in an asymmetric information environment. The direct motivation for management's opportunistic behavior can be broken down into dual dimensions: at the organizational level, firms are objectively motivated to reduce the cost of external monitoring based on the collective goals of tax avoidance strategy optimization (Kim et al., 2011b) or expansion strategy advancement (Kothari et al., 2005); on the individual level, management is motivated by self-interested motives, such as positional promotion incentives (Piotroski et al., 2015) and pay-for-performance contracting (Kim et al., 2011a), and tends to maintain its reputation in the marketplace by concealing negative information. Yet, as negative information builds up and surpasses the firm's information processing threshold, it will be concentrated and released to the capital market, leading to sharp fluctuations in the share price, and ultimately causing stock price crash risk (Kim et al., 2011b). Stock price crash risk not only mirrors corporate financial well-being, but also affects the confidence of investors and financial markets in the operation of enterprises (Kim et al., 2011a). Thus, stock price crash risk constitutes a "thermometer" for a firm's information transparency at the micro level and a "barometer" of financial market sentiment at the macro level.

Current studies center on the internal and external drivers of ESG performance, while research on the economic consequences of ESG rating divergence remains limited. The academic research on the causes of stock price crash risk focuses on external information asymmetry and deficiencies in internal control systems (Quan et al., 2016). Clearly, a systematic research framework addressing the influence and mechanisms of ESG rating divergence on stock price crash risk has yet to be established. Based on this, this paper empirically examines how ESG rating divergence affects stock price crash risk within a micro-firm analytical framework, using data on Shanghai and Shenzhen A-share listed firms from 2015 to 2022. The marginal contributions of this paper may be as follows:

- It reveals the mechanism by which ESG rating divergence exacerbates stock price crash risk through the dual paths of information asymmetry and external monitoring, and provides empirical evidence for enhancing market information transparency and strengthening the external monitoring mechanism.
- While the existing literature on the "information effect" of ESG rating divergence focuses on the domestic single-market environment and lacks cross-system comparison between international rating systems and local practices, this paper selects data from six authoritative rating agencies at home and abroad to explore whether there is an "in-

formation effect" of ESG rating divergence from a global perspective, which effectively bridges the gap in the existing literature in the dimension of internationalization.

- Heterogeneity analysis across property rights, marketization level, and industry pollution degree indicates that ESG rating divergence's impact on stock price crash risk is more pronounced in non-state-owned firms, low-marketization level firms and firms in high-pollution industries, echoing the capital market's differentiated regulation and regulators' protection priorities.

The structure of this paper is as follows: Section 2 presents a literature review and research hypotheses. Based on a review of studies on the relationship between ESG rating divergence and stock price crash risk, research hypotheses are proposed in conjunction with information asymmetry, external monitoring, and stakeholder theory. Section 3 is the research design, which explains the sample selection, variable definitions, and empirical model settings. Section 4 presents the results of baseline regression and robustness tests to verify the impact of ESG rating divergence on stock price crash risk. Section 5 further reveals the causal pathways and boundary conditions through mechanism analysis, heterogeneity tests, and dimensionality tests. Section 6 is the conclusion and insights, summarizing the research findings and proposing targeted recommendations.

2. Literature Review and Research Hypotheses

2.1. Literature Review

From macro-market and micro-enterprise dual dimensions, scholars at home and abroad have systematically studied ESG rating divergence's impact mechanisms. At the market macro level, such divergence may significantly weaken its informational reference value in investment decisions (J. Li et al., 2018), distort the efficiency of resource allocation (Avramov et al., 2022), and moreover push up the cost of corporate finance by hindering the dynamic optimization of the corporate information environment (He et al., 2023). Specifically, ESG rating divergence leads to the difficulty for market participants to accurately anchor the expected future returns of enterprises, which in turn generates a rise in systematic risk premiums, inhibits investors' willingness to allocate risky assets, and ultimately leads to downward pressure on stock returns (Wang et al., 2024), thereby affecting capital market stability. At the corporate micro-governance level, the information asymmetry embedded in ESG rating divergence can interfere with stakeholders' consistent perceptions of corporate ESG practices, potentially leading to weaker positive valuation judgments and reduced equity financing capabilities, which in turn exacerbate operational risk exposure, ultimately manifesting in a significant decline in stock liquidity (X. Li et al., 2023) and more frequent and intense corporate share price volatility (Berg et al., 2022). Scholars have found that the synergy between institutional reforms and governance mechanisms can enhance the stability of micro-enterprise operations—this provides a micro-foundation for understanding how standardized governance practices mitigate ESG rating divergence (Alruwaili et al., 2023b), and robust governance mechanisms can mitigate the negative impact of macro uncertainty on micro-enterprises—this extends the understanding of governance effectiveness to crisis scenarios, and in such contexts, governance mechanisms may also reduce ESG rating divergence by enhancing enterprises' operational stability amid external shocks (Alshdaifat et al., 2025). In the field of green innovation, ESG rating divergence can lead to a symbolic growth and substantial quality degradation of corporate green innovation outputs, which in turn lead to a tendency of "bubbling" of green innovation activities (Q. Li & Chen, 2024). Analyzed from an audit oversight perspective, ESG rating divergence leads to attrition of audit efficiency by reducing the quality of corporate disclosure (Gao et al., 2025) and significantly increases the probability of an auditor issuing a non-standard audit opinion (P. Li & Wang, 2025). Scholars found IFRS

adoption by Saudi listed firms enhanced financial reporting quality with firm-specific characteristics moderated, complementing audit-related research by showing that institutional frameworks and operational practices jointly affect disclosure quality and ESG rating divergence (Alruwaili et al., 2023a). Research found that unstable audit practices in developing systems may exacerbate non-standardized disclosure and increase ESG rating divergence, especially in governance dimensions linked to audit quality (Alhazmi et al., 2024). Not only that, suppliers' ESG rating divergence reduces the operational resilience of the focal firm and constrains the firm's ability to create sustainable value (Zhao et al., 2024). Studies have pointed out that boards with stronger sustainability-related skills can better align corporate ESG practices with stakeholders' expectations, thereby reducing the information asymmetry that drives ESG rating divergence (Alruwaili, 2025).

Existing research on the factors influencing stock price crash risk can be categorized into two dimensions: internal and external. In terms of the internal mechanism, internal control deficiencies of firms constitute a core source of risk. The influencing factors of internal control deficiencies are reflected in two interacting dimensions: one is inadequate information disclosure and a non-transparent governance environment caused by internal control failures (Quan et al., 2016), and the other is the bad news hiding behavior of management based on the principal-agent conflict (Huang & Zhou, 2012). On the external dimension, the impact path covers two aspects: investor behavioral characteristics and macro-environmental shocks. Based on behavioral finance theory, irrational investor sentiment can amplify market volatility through the pricing mechanism (Song & Hu, 2017), exacerbating stock price crash risk. Moreover, external macro-uncertainty events represented by the COVID-19 pandemic (Yang & Wang, 2021) have become a threatening factor to the stability of the stock market that is of concern to regulators and academics due to their systemic impact on market expectations.

2.2. Research Hypothesis

Based on the integration of information asymmetry theory and investor response mechanism, this paper systematically examines dual paths of ESG rating divergence to stock price crash risk. Specifically, such divergence may show a notable "double-edged sword" effect on it.

Accounting for ESG raters' evaluation criteria heterogeneity, ESG rating divergence's impact mechanism on stock price crash risk can be analyzed via information asymmetry theory. Accounting for ESG raters' evaluation criteria heterogeneity, ESG rating divergence's impact mechanism on stock price crash risk can be analyzed via information asymmetry theory (Hutton et al., 2009). Notably, managers' opportunistic "greenwashing", opposed to firms' real ESG practices, deliberately lowers info disclosure quality and raises info asymmetry, thus causing systematic gaps in evaluation results and forming an endogenous source of such divergence.

Stakeholders refer to all individuals or organizations affected by corporate operations. In the study of ESG rating divergence, they mainly include companies, investors, the public, and regulatory agencies. The impact of ESG rating divergence on the capital market can be analyzed from three dimensions: investor decision making, public and regulatory awareness, and corporate risk transmission. For investors, the existence of ESG rating divergence significantly increases the information processing cost of investors (Zhou et al., 2023), and when ESG rating divergence exists, it is difficult for market participants to form a stable consensus on expectations, leading to a reduction in the reference value of decision making. Investors tend to adopt conservative trading strategies to avoid uncertainty, thus increasing market friction. In addition, when ESG ratings are highly divergent, information uncertainty triggers investors' loss aversion, which is manifested in investors' oversensitiv-

ity to negative signals and risk perception bias (R. Li et al., 2024). The superimposed effect of the above psychology and behavior is ultimately transmitted to the market trading level, manifesting in a significant increase in stock price crash risk. For the public and regulatory authorities, this cognitive conflict can affect corporate reputation, ultimately affecting stock prices through market trading behavior and amplifying the risk of a stock price collapse. For companies, ESG rating divergence triggered by management's opportunistic behavior can eventually create a risk clustering effect through the feedback mechanism of the capital market, which may trigger a nonlinear decline in the stock price when the accumulation of negative information breaks through the threshold (Kim et al., 2011b). Further, the negative impact of ESG rating divergence on firms has a significant transmission lag and cumulative nature, weakening firms' value creation and value management capabilities through the degradation of the quality of green innovation activities (Q. Li & Chen, 2024) and the reduction in auditing efficiency (Gao et al., 2025), and creating opportunities for the incubation of stock price crash risks. Based on this, this paper proposes the following research hypotheses:

H1a. *ESG rating divergence increases stock price crash risk.*

Under market participants' information integration theoretical framework, ESG rating divergence's mitigating effect on stock price crash risk can be analyzed via information complementarity mechanism, i.e., such divergence may also lower it by delivering multidimensional information (Shao et al., 2025). Specifically, this rating divergence is essentially the differentiated mining and interpretation of corporate environmental, social, governance and other dimensional information by multiple assessment bodies (Lamont, 2012), which helps investors construct a more complete ESG cognitive picture through the complementary effect of information, reduces cognitive bias due to single-dimensional evaluation, and thus reduces the risk of abnormal stock price volatility. And it has been empirically shown that ESG rating divergence is negatively correlated with stock price synchronization (Liu et al., 2023), suggesting that rating divergence can enhance the information content of stock prices. According to the efficient market hypothesis, when stock prices contain more firm-specific information, the market's overreaction to systemic risk will be mitigated, thus reducing the probability of abnormal stock price volatility. On this basis, this paper presents the following research hypothesis:

H1b. *ESG rating divergence reduces stock price crash risk.*

Due to the existence of artificial "greenwashing" behavior in the causes of ESG rating divergence, this behavior triggers a decrease in the level of trust of market participants, and the accumulation of trust deficit directly affects corporate reputation capital, forming a negative reputational shock. Examined from the dimension of capital market impact, the economic consequences of negative corporate reputation present a double effect: First, they are transmitted through the financing channel, inhibiting the exogenous financing ability of enterprises, which is manifested in the contraction of financing scale (Zhu, 2020). Financing constraints may weaken the liquidity of enterprises, and when operational risks or external crises occur, the tight financial chain is prone to trigger the market's concern about the enterprises' ability to continue operations, creating potential pressure on the stock price decline. Second, at the level of asset pricing, negative corporate reputation triggers investors' risk revaluation, prompting stock prices to move downward and pushing up risk premium (Chen et al., 2005), and when stock prices continue to be depressed due to reputational risk, it may further amplify market panic, which is very likely to lead to a nonlinear crash of stock prices.

Corporate media attention is used as a core indicator to measure the frequency of news media coverage of corporate production and operation activities and major public opinion events. Based on the information asymmetry theory, objective and neutral media reports can strengthen the effectiveness of external monitoring and effectively optimize the information environment by generating targeted public information (Kim et al., 2019). When ESG rating disagreement occurs, the media face significantly higher information screening costs and validation difficulties, which may lead to biased reporting and reduced reporting. This decrease in information processing efficiency leads to a decrease in media attention, which in turn shrinks the scale of corporate information available to stakeholders and its verifiability (Rong et al., 2025). The deterioration of the information environment breaks the information balance between investors and firms, increases the hidden nature of management's opportunistic behavior, and ultimately pushes up stock price crash risk through the risk accumulation effect. On this basis, this paper presents the following research hypothesis. The research hypothesis path diagram for this paper is shown in Figure 1.

H2. *ESG rating divergence increases stock price crash risk by increasing the risk of reputational damage and reducing the external scrutiny faced by firms.*

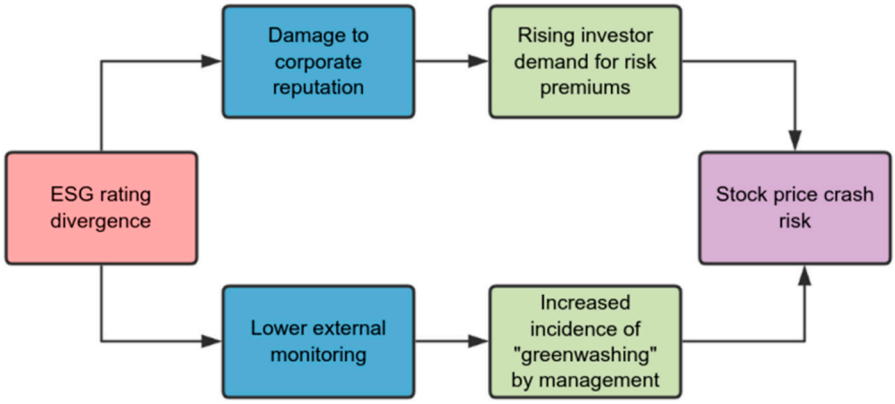


Figure 1. Research hypotheses.

3. Research Design

3.1. Sample Selection and Data Sources

This paper chose 2015–2022 Shanghai–Shenzhen A-share listed firm data, filtered as: (1) eliminating ST/*ST firms (since these firms typically suffer from financial distress or operational distortions that deviate from normal listed enterprises, potentially biasing empirical inferences); (2) removing financial/insurance firms; (3) samples with missing data for the main variables are excluded; (4) Winsorizing all continuous variables at 1% to prevent extreme value effects. Finally, 25,688 firm-year observations are obtained. Among them, all firm-level data are from CSMAR and CNRDS database.

3.2. Variable Definition

3.2.1. ESG Rating Divergence

This paper selects six domestic and international mainstream ESG rating agencies as research samples: Bloomberg, SynTao Green Finance, FTSE Russell, Sino-Securities Index, Susallwave, and Wind. To address the differentiated rating systems of institutions, this study uses an interval standardization method to unify the process: The raw ratings are mapped to an equally spaced interval of 0–9 points by a linear transformation to ensure that ratings with different scales have equal weights in the divergence measure. Finally, the

standardized rating scores of each agency are used as variables to construct the ESG rating divergence indicator by calculating the standard deviation. This indicator can effectively capture the degree of dispersion of assessment results among rating agencies and provide a quantitative basis for subsequent analysis.

3.2.2. Stock Price Crash Risk

Based on the established research results (Kim et al., 2011b), a two-dimensional measurement index system of stock price crash risk is constructed through weekly stock returns.

Firstly, the weekly stock return ($W_{i,t}$) is constructed.

$$R_{i,t} = \beta_0 + \beta_1 R_{m,t-2} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t} + \beta_4 R_{m,t+1} + \beta_5 R_{m,t+2} + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ represents the compounded return rate of stock i in week t considering cash dividend reinvestment, and $R_{m,t}$ represents the free-float market capitalization weighted average weekly return rate of the A-share market. In this paper, we include two lags and two periods ahead of market returns in model (1), which aims to correct for return measurement bias due to asynchronous trading, and the residuals $\varepsilon_{i,t}$ characterize the portion of individual stock returns that is not explained by market systematic risk. Assumptions about: The error term in our market model regression (Equation (1)) adheres to the standard classical linear regression assumptions: Zero Conditional Mean: $E[\varepsilon_{i,t}][R_m] = 0$. Homoscedasticity: To address potential heteroscedasticity, we employ robust standard errors in all relevant estimations. Independence from Regressors: $\varepsilon_{i,t}$ is uncorrelated with the market returns (R_m) at all lags and leads included in the model. Our measure of firm-specific returns relies critically on these residuals. Estimation of Coefficients $\beta_0,\ldots,\beta_5$: The coefficients ($\beta_0,\ldots,\beta_5$) in Equation (1) are estimated using Ordinary Least Squares (OLS) regression applied to the time series of the firm's weekly returns and the corresponding market returns over the same period. This estimation is conducted separately for each firm-year to generate the firm-specific residual returns ($\varepsilon_{i,t}$) necessary for our subsequent crash risk measures. Sufficient data points per firm-year are required for reliable estimation. The firm-specific return of stock i in week t is $W_{i,t} = \ln(1 + \varepsilon_{i,t})$, a variable that captures firm-specific information-driven stock price volatility. (The data in this paper was tested using extreme value testing. The minimum value of $\varepsilon_{i,t}$ was -0.88, and there were no cases where $\varepsilon_{i,t} \leq -1$.)

Secondly, the negative earnings bias coefficient ($NCSKEW_{i,t}$) and the ratio of upward and downward earnings fluctuations ($DUVOL_{i,t}$) are calculated based on firm-specific earnings.

$$NCSKEW_{i,t} = -\left[n(n-1)^{3/2} \sum_{\tau=t-51}^{t} W_{i,\tau}^3\right] / \left[(n-1)(n-2)\left(\sum_{\tau=t-51}^{t} W_{i,\tau}^2\right)^{3/2}\right] \quad (2)$$

$$DUVOL_{i,t} = \ln\left\{\left[(n_u - 1)\sum_{k \in UP_t} W_{i,k}^2\right] / \left[(n_d - 1)\sum_{m \in DOWN_t} W_{i,m}^2\right]\right\} \quad (3)$$

Equations (2) and (3) are calculated using a rolling time window based on annual periods. Specifically, the crash risk indicator for each year is calculated using data from the 52 trading weeks of that year (If the year has fewer than 52 weeks, the company's sample is excluded). The summation symbol in Equation (2) denotes the sum of the cubed characteristic returns for all valid trading weeks within year t, where $n = 52$. Using natural years as the unit (t = year-end point), the calculation is performed using only the 52 trading weeks from 1 January to 31 December of that year (the summation range in the formula is $\in$[Year_start, Year_end]). In Equation (3), UP_t and $DOWN_t$ represent the sets of weekly sequence numbers for all upward and downward weeks in year t, respectively. The

summation operation only covers the subset of weeks corresponding to that year. Where n is the number of trading weeks per year for stock i, and $n_u(n_d)$ is the number of weeks in which the week-specific return of stock i is higher (lower) than the average annual return. $NCSKEW_{i,t}$ measures the risk of a stock price crash by portraying the degree of left-skewed of the return distribution, with larger absolute values indicating a higher probability of negative extreme returns, i.e., a higher risk of a stock price crash. $DUVOL_{i,t}$, on the other hand, captures the overreaction of stock prices to negative information by comparing the volatility clustering effect in the down phase with that in the up phase; a larger value of this indicator implies a more pronounced left-skewed characteristic of the return distribution, i.e., a higher risk of a stock price crash.

3.2.3. Control Variables

Following prior research (Shao et al., 2025), this paper selects firm size (Size), leverage ratio (Lev), return on assets (ROA), number of board of directors (Board), largest shareholder share proportion (Top1), audit quality (Big4), annualized weekly return on share price (Ret), level of volatility of share price (Sigma), institutional investor shareholding ratio (INST), operating income growth rate (Growth) and degree of equity balance (Balance1) are used as control variables. Specific variables are defined in Table 1.

Table 1. Variable definition.

Variable	Variable Definitions
NCSKEW	Negative return skewness factor
DUVOL	Ratio of upward and downward fluctuations in returns
ESGdif6	Standard deviation of ESG ratings from six rating agencies: Bloomberg, SynTao Green Finance, FTSE Russell, Sino-Securities Index, Susallwave, and Wind
Size	Fixed Assets/Total Assets
Lev	EBITDA/average total assets
ROA	Natural logarithm of the number of board members
Board	Number of independent directors/number of board members
Top1	Number of shares held by the largest shareholder/ total number of shares
Big4	(Current Year − Year of Establishment + 1) take the natural logarithm
Ret	(Market value of outstanding shares + number of non-outstanding shares x net assets per share + book value of liabilities)/Total assets
Sigma	Growth in operating income/total operating income of the previous year
INST	1 if the enterprise is audited by a Big 4 accounting firm, 0 otherwise
Growth	Net cash flow from operating activities/total assets of the enterprise
Balance1	Degree of equity balance
Industry	Industry fixed effects
Year	Time fixed effects

3.3. Empirical Modeling

A two-way fixed effects regression model is used to examine the effect of ESG rating divergence on stock price crash risk as follows:

$$NCSKEW_{i,t}/DUVOL_{i,t} = \alpha_0 + \alpha_1 ESGdif6_{i,t} + \sum_{k=1}^{11} \alpha_{c,k,i,t} Control_{k,i,t} + \varepsilon_{i,t} + Industry_{i,m} + Year_t \quad (4)$$

In the setting of model (4), this study focuses on the estimation of regression coefficients for the independent variable ESGdif6. Per hypothesis H1a, the coefficient is expected to show a statistically significant positive estimate, meaning ESG rating divergence raises stock price crash risk. $\sum_{k=1}^{11} \alpha_{c,k,i,t}$ represents the 11 control variables in the model, as defined in Table 1. At the same time, year fixed effects and industry fixed effects were included in the model construction, represented by $Year_t$ and $Industry_{i,m}$, respectively, to control for common shocks in the time dimension and heterogeneity at the industry level, thereby eliminating the influence of other potential confounding factors at the measurement level. To reduce estimation bias from residual serial correlation and heteroskedasticity, all regression standard errors are adjusted via firm-level clustering.

4. Empirical Results and Analysis

4.1. Descriptive Statistics

Table 2 presents descriptive statistics. ESGdif6 has a maximum of 2.828 and a mean of 0.96, showing large ESG rating divergence among sample firms, with representative and reasonable samples. Stock crash risk proxies NCSKEW and DUVOL have means of −0.321 and −0.206, SDs 0.737 and 0.483; crash risk is moderate but varies significantly across firms, with prominent heterogeneity. Other control variables align with existing studies (Shao et al., 2025). Size has a SD of 1.301, indicating a concentrated firm size distribution; ROA has a mean of 0.038, showing low overall profitability; Big4 has a mean of 0.061, meaning 6.1% of samples are audited by Big 4; growth has a mean of 0.158, indicating good revenue growth overall.

Table 2. Descriptive statistics.

Variable	N	Mean	Min	Max	P50	SD
NCSKEW	25,688	−0.321	−2.397	1.655	−0.280	0.737
DUVOL	25,688	−0.206	−1.356	1.006	−0.208	0.483
ESGdif6	25,688	0.960	0.000	2.828	1.000	0.720
Size	25,688	22.340	20.020	26.390	22.150	1.301
Lev	25,688	0.420	0.061	0.905	0.411	0.201
ROA	25,688	0.038	−0.263	0.228	0.038	0.071
Board	25,688	2.106	1.609	2.639	2.197	0.196
Balance1	25,688	0.381	0.013	0.994	0.307	0.284
Big4	25,688	0.061	0.000	1.000	0.000	0.239
Ret	25,688	0.002	−0.015	0.035	0.001	0.010
Sigma	25,688	0.067	0.026	0.158	0.061	0.027
INST	25,688	0.424	0.003	0.908	0.435	0.247
Growth	25,688	0.158	−0.579	2.292	0.099	0.390

4.2. Baseline Regression

Table 3 shows baseline regression results. ESG rating divergence's coefficients are significantly positive at the 1% level; each unit rise in it increases NCSKEW and DUVOL by 2.4% and 1.5% respectively, indicating that it significantly raises stock price crash risk, supporting H1a.

For control variables: Big4's coefficient is insignificant, meaning Big 4 audit has little impact on it. Lev, Balance1, INST, and Growth coefficients are significantly positive, showing that firms with high gearing, strong equity checks, high institutional holdings, and higher revenue growth face higher crash risk. Size, Board, Ret, and Sigma coefficients are significantly negative, indicating that larger firms, bigger boards, higher stock returns, and higher volatility have lower risk. Overall, control variables affect it differently; these significant links provide insights into its influencing factors.

Table 3. Baseline regression.

	(1)	(2)
	NCSKEW	**DUVOL**
L.ESGdif6	0.024 ***	0.015 ***
	(3.50)	(3.39)
Size	−0.045 ***	−0.036 ***
	(−8.41)	(−10.47)
Lev	0.080 **	0.075 ***
	(2.51)	(3.64)
ROA	0.211 **	0.085
	(2.55)	(1.59)
Board	−0.070 ***	−0.041 **
	(−2.68)	(−2.42)
Balance1	0.060 ***	0.038 ***
	(3.49)	(3.42)
Big4	−0.006	−0.005
	(−0.30)	(−0.34)
Ret	−15.593 ***	−11.180 ***
	(−21.29)	(−23.54)
Sigma	−7.802 ***	−4.816 ***
	(−28.32)	(−26.95)
INST	0.096 ***	0.059 ***
	(4.16)	(3.92)
Growth	0.100 ***	0.053 ***
	(7.12)	(5.81)
_cons	1.175 ***	0.896 ***
	(10.00)	(11.76)
N	25,688	25,688
IND	YES	YES
YEAR	YES	YES
R-Squared	0.096	0.098

(Significance levels are denoted as follows: ** $p < 0.05$, and *** $p < 0.01$.)

4.3. Robustness Tests

4.3.1. Endogeneity Tests

1. Instrumental variable regression

To tackle endogeneity from mutual causality, this study uses instrumental variable approach for endogeneity test. Given that the established literature indicates that ESG ratings are significantly affected by provincial characteristics and industry attributes (Arouri et al., 2019), this paper selects the annual median of provinces with divergent ESG ratings and the industry median as the instrumental variable Esgdiss_IV. This strategy satisfies the requirement of exogeneity of instrumental variables—the provincial annual median and industry median reflect the macro-environmental characteristics of ESG rating divergence, which are not directly related to individual firms' behaviors; and it also has a relevance basis—ESG rating divergence at the regional or industry level can effectively explain the ESG rating uncertainty faced by individual firms, thus providing an analytical framework that meets the econometric requirements for solving the endogeneity problem.

Table 4 column (1) shows that Esgdiss_IV's coefficient on ESGdif6 is 0.972, significantly positive at 1%, indicating strong correlation between instrumental variables and ESGdif6, meeting validity requirements. Table 4 columns (2)–(3) show ESGdif6's effect on stock price crash risk proxies: instrumental variable regression results align with benchmark ones, with robust conclusions.

Table 4. Instrumental variable regression.

	(1)	(2)	(3)
	ESGdif6	**NCSKEW**	**DUVOL**
Esgdiss_IV	0.972 ***		
	(100.91)		
L.ESGdif6		0.044 ***	0.032 ***
		(4.65)	(5.17)
Size	0.073 ***	−0.032 ***	−0.028 ***
	(19.59)	(−6.43)	(−8.65)
Lev	0.048 **	0.025	0.030
	(2.18)	(0.86)	(1.62)
ROA	−0.302 ***	−0.055	−0.055
	(−5.41)	(−0.73)	(−1.12)
Board	−0.030 *	−0.048 **	−0.028 *
	(−1.70)	(−2.00)	(−1.82)
Balance1	−0.022 *	0.015	0.011
	(−1.92)	(0.96)	(1.05)
Big4	0.006	−0.018	−0.013
	(0.42)	(−0.92)	(−0.96)
Ret	1.801 ***	−7.979 ***	−6.909 ***
	(3.34)	(−13.16)	(−17.44)
Sigma	−0.740 ***	−5.282 ***	−3.142 ***
	(−3.89)	(−23.45)	(−21.35)
INST	0.037 **	0.089 ***	0.054 ***
	(2.38)	(4.28)	(4.00)
Growth	−0.037 ***	0.054 ***	0.024 ***
	(−4.14)	(4.47)	(3.09)
_cons	−1.503 ***	0.842 ***	0.691 ***
	(−17.89)	(7.83)	(9.84)
N	25,688	25,688	25,688
IND	YES	YES	YES
YEAR	YES	YES	YES
R-Squared	0.488	0.066	0.073

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

2. Propensity score matching (PSM)

To control self-selection bias's potential impact on results, this study uses PSM for endogeneity analysis (Austin, 2011; Garrido et al., 2014). The specific implementation steps are as follows: firstly, the samples are grouped based on the ESG rating divergence index, and the samples with a higher degree of ESG rating divergence are defined as the experimental group, i.e., the value of 1 is assigned when ESGdif6 is greater than Esgdiss_IV, which characterizes the set of samples with a higher degree of ESG rating divergence. In this paper, the set of control variables included in the baseline regression model was used as covariates to parameterize the propensity score, which quantifies the conditional probability that the sample will be assigned to the experimental group, by constructing a logit regression model. Then, the 1:3 nearest neighbor matching method was used to construct a feature-balanced set of paired samples by screening out matching samples from the control group that were closest to the propensity score values of the experimental group samples. As shown in Table 5, the results of the regression analyses conducted again on the matched samples show that core independent variables' coefficient estimates and significance align with baseline results, further confirming the robustness and reliability of this study's conclusions.

Table 5. Propensity score matching.

	(1)	(2)
	NCSKEW	**DUVOL**
L.ESGdif6	0.021 ***	0.013 **
	(2.65)	(2.52)
Size	−0.041 ***	−0.034 ***
	(−6.64)	(−8.40)
Lev	0.131 ***	0.116 ***
	(3.49)	(4.73)
ROA	0.220 **	0.079
	(2.19)	(1.20)
Board	−0.084 ***	−0.047 **
	(−2.82)	(−2.38)
Balance1	0.064 ***	0.041 ***
	(3.17)	(3.11)
Big4	−0.009	−0.006
	(−0.39)	(−0.39)
Ret	−14.955 ***	−10.804 ***
	(−17.47)	(−19.29)
Sigma	−7.127 ***	−4.433 ***
	(−22.29)	(−21.18)
INST	0.099 ***	0.064 ***
	(3.60)	(3.55)
Growth	0.104 ***	0.053 ***
	(6.49)	(5.03)
_cons	1.039 ***	0.801 ***
	(7.57)	(8.92)
N	15,002	15,002
IND	YES	YES
YEAR	YES	YES
R-Squared	0.085	0.087

(Significance levels are denoted as follows: ** $p < 0.05$, *** $p < 0.01$.)

3. Lagged independent variables

Due to their causal time-series link, this paper re-regresses ESG rating divergence with two-period lag (L2.ESGdif6), controlling industry and year fixed effects; results are in Table 6. Findings show that coefficients are significantly positive at 1% when L2.ESGdif6 is the independent variable, showing that it significantly positively affects stock price crash risk. In addition, in order to avoid the impact of the previous period's stock price crash risk on the current period's stock price crash risk, this study re-executed the GMM regression. Details are provided in Appendix A.

4.3.2. Replacement of Key Variable Measures

Columns (1) and (2) in Table 7 are based on the regression analysis of data from four domestic and international mainstream ESG rating agencies, namely, Bloomberg, Sino-Securities Index, SynTao Green Finance and Wind, to re-measure the standard deviation of ESG rating scores under the framework of the unified scoring standard and construct a new independent variable, L.ESGdif4. Results show that its coefficients remain positively significant at 1% after replacement, consistent with baseline findings, confirming model robustness.

Table 6. Lagged independent variables.

	(1)	(2)
	NCSKEW	**DUVOL**
L2.ESGdif6	0.038 ***	0.025 ***
	(5.13)	(5.26)
Size	−0.034 ***	−0.030 ***
	(−5.79)	(−7.94)
Lev	0.043	0.057 **
	(1.22)	(2.55)
ROA	0.154 *	0.069
	(1.72)	(1.20)
Board	−0.059 **	−0.037 **
	(−2.04)	(−2.00)
Balance1	0.065 ***	0.043 ***
	(3.41)	(3.49)
Big4	0.005	0.001
	(0.21)	(0.04)
Ret	−17.593 ***	−12.617 ***
	(−22.29)	(−24.80)
Sigma	−7.295 ***	−4.378 ***
	(−24.02)	(−22.36)
INST	0.085 ***	0.051 ***
	(3.23)	(3.03)
Growth	0.121 ***	0.067 ***
	(7.71)	(6.56)
_cons	0.918 ***	0.751 ***
	(7.04)	(8.94)
N	25,688	25,688
IND	YES	YES
YEAR	YES	YES
R-Squared	0.106	0.108

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

Table 7. Reducing the sample interval.

	(1)	(2)	(3)	(4)	(5)	(6)
	Replacement of Key Variable Measures		**Double Cluster Analysis**		**Reducing the Sample Interval**	
	NCSKEW	**DUVOL**	**NCSKEW**	**DUVOL**	**NCSKEW**	**DUVOL**
L.ESGdif4	0.030 ***	0.021 ***				
	(4.63)	(4.92)				
L.ESGdif6			0.024 ***	0.015 ***	0.030 **	0.028 ***
			(2.93)	(3.26)	(2.56)	(3.70)
Size	−0.045 ***	−0.036 ***	−0.045 ***	−0.036 ***	−0.045 ***	−0.034 ***
	(−8.50)	(−10.63)	(−6.24)	(−8.22)	(−5.55)	(−6.50)
Lev	0.083 ***	0.077 ***	0.080 **	0.075 ***	0.073	0.079 ***
	(2.61)	(3.76)	(2.62)	(3.85)	(1.56)	(2.59)
ROA	0.230 ***	0.100 *	0.211 *	0.085	0.415 ***	0.303 ***
	(2.78)	(1.86)	(1.95)	(1.35)	(3.31)	(3.73)
Board	−0.067 **	−0.039 **	−0.070 **	−0.041 **	−0.059	−0.035
	(−2.57)	(−2.30)	(−2.03)	(−2.24)	(−1.57)	(−1.43)
Balance1	0.058 ***	0.037 ***	0.060 ***	0.038 ***	0.086 ***	0.052 ***
	(3.36)	(3.29)	(2.72)	(2.97)	(3.37)	(3.18)
Big4	−0.009	−0.007	−0.006	−0.005	−0.006	−0.011
	(−0.42)	(−0.47)	(−0.29)	(−0.29)	(−0.20)	(−0.53)
Ret	−15.872 ***	−11.406 ***	−15.593 ***	−11.180 ***	−23.071 ***	−16.383 ***
	(−21.54)	(−23.87)	(−15.36)	(−17.91)	(−20.82)	(−22.81)
Sigma	−7.803 ***	−4.815 ***	−7.802 ***	−4.816 ***	−8.089 ***	−5.180 ***
	(−28.34)	(−26.96)	(−16.02)	(−18.90)	(−19.00)	(−18.77)
INST	0.100 ***	0.062 ***	0.096 ***	0.059 ***	0.133 ***	0.078 ***
	(4.31)	(4.09)	(4.67)	(4.36)	(3.94)	(3.59)
Growth	0.102 ***	0.054 ***	0.100 ***	0.053 ***	0.065 ***	0.032 **
	(7.21)	(5.94)	(7.80)	(6.25)	(3.19)	(2.45)
_cons	1.169 ***	0.895 ***	1.175 ***	0.896 ***	1.114 ***	0.813 ***
	(9.98)	(11.79)	(7.38)	(8.85)	(6.18)	(6.96)
N	25,688	25,688	25,688	25,688	10,084	10,084
IND	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
R-Squared	0.096	0.099	0.096	0.098	0.102	0.109

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.).

4.3.3. Double Cluster Analysis

Per Table 7 cols (3)–(4), double clustering analysis (Petersen, 2008), ESG rating divergence's coefficients on stock price crash risk stay significantly positive after controlling

individual and industry-level clustering standard errors. This means that ESG rating divergence's positive effect on stock price crash risk persists under strictly controlling individual heterogeneity and industry characteristics, with results unaffected by them, reaffirming their relationship's robustness and reliability.

4.3.4. Reducing the Sample Interval

Columns (5) and (6) of Table 7 show the results of the reduced sample interval. Given that the global outbreak of COVID-19 in 2020 significantly increased public attention to public health and ecosystem issues, the extent to which firms consider ESG practices has increased accordingly. This paper re-regresses by excluding post-2020 samples, using 2015–2019 window. Results show that ESG rating divergence coefficients remain statistically significantly positive, further supporting core hypothesis "it exacerbates stock price crash risk" and confirming conclusion robustness.

5. Further Tests

5.1. Mechanism Analysis

Combined with the theoretical analysis in the previous section, ESG rating divergence may increase stock price crash risk through two paths: reducing the external monitoring faced by firms and increasing the risk of corporate reputation damage. In order to verify whether the above mechanism is valid, a mechanism testing model is constructed (Jiang, 2022). The specific formula is as follows:

$$\mathrm{Media}_{i,t}/\mathrm{Rep}_{i,t} = \gamma_0 + \gamma_1 \mathrm{ESGdif6}_{i,t} + \sum_{k=1}^{11} \gamma_{c,k,i,t} \mathrm{Control}_{k,i,t} + \varepsilon_{i,t} + \mathrm{Industry}_{i,m} + \mathrm{Year}_t \quad (5)$$

Referring to the previous research paradigm (Zhang et al., 2024), we took the natural logarithm of the number of online media reports plus one to construct a proxy indicator of external monitoring intensity, labeled "External Attention (Media)". Table 8 results show that in the external attention mechanism model, ESGdif6's regression coefficient is significantly negative at the 1% level, indicating that ESG rating divergence significantly reduces firms' external monitoring. When external monitoring attention decreases, it may weaken the constraining effectiveness of external regulatory mechanisms, which in turn increases the probability of opportunistic behavior in corporate disclosure. This systematically elevates information asymmetry and raises stock price crash risk (Tang et al., 2025). Changes in external monitoring and reputational damage risk during the sample period are shown in Figure 2.

Drawing on the previous practice of measuring corporate reputation risk (Rep) (Guan & Zhang, 2019), we selected an assessment system of 12 corporate reputation indicators. Using factor analysis, we extracted common factors to calculate a composite score for each firm. We then grouped scores into deciles and assigned values 1–10 to form the corporate reputation variable (Rep), where higher values indicate higher reputation levels. In Rep mechanism, ESGdif6's coefficient is significantly positive at 1%, showing that it raises reputational damage risk. Corporate reputation negative shocks have statistically significant positive impact on stock price crash risk by weakening investor trust (Song & Hu, 2017). Overall, ESG rating divergence worsens stock price crash risk via two paths: raising reputational harm risk and weakening external monitoring. Therefore, H2 is proven.

Table 8. Mechanism analysis.

	(1)	(2)
	External Monitoring	**Reputation Damage Risk**
	Media	**Rep**
L.ESGdif6	−0.049 ***	0.125 ***
	(−5.89)	(7.77)
Size	0.420 ***	1.212 ***
	(67.01)	(107.69)
Lev	−0.336 ***	−1.755 ***
	(−8.96)	(−25.91)
ROA	0.794 ***	23.213 ***
	(7.90)	(133.47)
Board	0.041	1.258 ***
	(1.34)	(23.72)
Balance1	0.060 ***	0.074 **
	(2.91)	(2.10)
Big4	0.426 ***	1.587 ***
	(17.40)	(37.72)
Ret	−1.537 *	15.132 ***
	(−1.94)	(9.33)
Sigma	14.492 ***	−5.281 ***
	(49.42)	(−9.06)
INST	−0.057 **	0.629 ***
	(−2.07)	(13.15)
Growth	−0.024	0.174 ***
	(−1.60)	(6.67)
_cons	−5.360 ***	−24.719 ***
	(−38.49)	(−97.09)
N	25,688	25,688
IND	YES	YES
YEAR	YES	YES
R-Squared	0.327	0.765

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

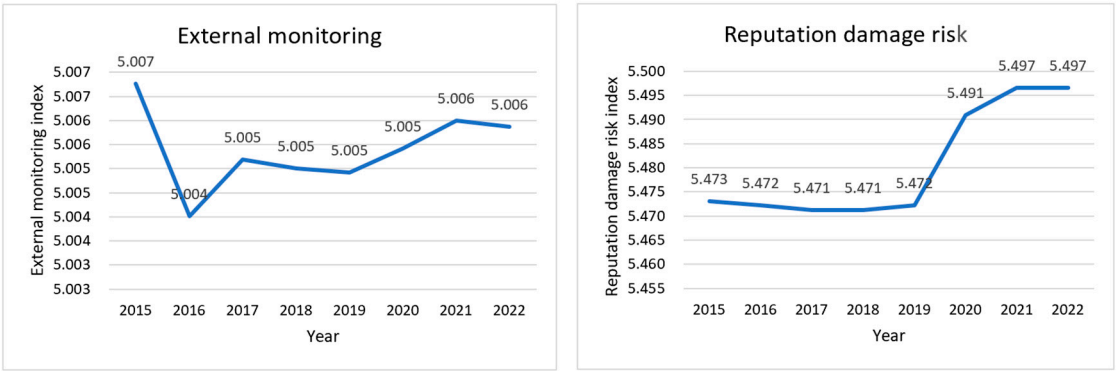


Figure 2. External monitoring and reputation damage risk.

5.2. Heterogeneity Analysis

5.2.1. Heterogeneity Test Based on the Nature of Property Rights

As the core entity of the country's strategic resource allocation, state-owned enterprises carry unique institutional responsibilities in the cultivation of new quality productivity, and their obligations to fulfill their social responsibilities have stronger policy constraints and higher stakeholder expectations than those of non-state-owned enterprises. Thus, to test ESG rating divergence's impact in firms with different property rights, this paper splits samples into state-owned and non-state-owned enterprise groups for group regression tests, with results in Table 9. Results show that ESG rating divergence's regression coefficients in non-state-owned firm samples exhibit more significant positive statistical traits.

Table 9. Heterogeneity analysis (nature of property rights).

	(1)	(2)	(3)	(4)
	State-Owned Enterprises	Non-State-Owned Enterprises	State-Owned Enterprises	Non-State-Owned Enterprises
	NCSKEW	NCSKEW	DUVOL	DUVOL
L.ESGdif6	0.011	0.072 ***	0.002	0.044 ***
	(0.96)	(4.98)	(0.30)	(4.70)
Size	−0.017 *	−0.049 ***	−0.023 ***	−0.040 ***
	(−1.76)	(−4.50)	(−4.30)	(−5.58)
Lev	0.067	0.018	0.112 ***	0.054
	(1.11)	(0.27)	(3.51)	(1.23)
ROA	0.178	−0.035	0.087	0.036
	(1.25)	(−0.17)	(1.11)	(0.26)
Board	−0.055	−0.035	−0.011	−0.046
	(−1.16)	(−0.68)	(−0.44)	(−1.34)
Balance1	0.074 **	0.046	0.056 ***	0.026
	(2.35)	(1.27)	(3.29)	(1.10)
Big4	−0.016	0.009	0.024	0.002
	(−0.41)	(0.27)	(1.09)	(0.08)
Ret	−17.263 ***	−19.966 ***	−9.972 ***	−13.575 ***
	(−14.47)	(−12.20)	(−14.79)	(−12.66)
Sigma	−5.776 ***	−7.343 ***	−4.093 ***	−4.691 ***
	(−11.92)	(−12.65)	(−15.61)	(−12.33)
INST	0.138 ***	0.055	0.078 ***	0.015
	(3.29)	(0.85)	(3.58)	(0.35)
Growth	0.110 ***	0.146 ***	0.039 ***	0.078 ***
	(4.47)	(4.92)	(2.98)	(4.03)
_cons	0.448 **	1.188 ***	0.471 ***	1.003 ***
	(2.02)	(4.98)	(3.93)	(6.43)
N	9731	15,957	9731	15,957
IND	YES	YES	YES	YES
YEAR	YES	YES	YES	YES
p-value	0.002		0.027	
R-Squared	0.050	0.056	0.060	0.061

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

Non-state-owned enterprises have a natural disadvantage in the accumulation of institutional reputational capital. Due to the lack of implicit government guarantees and policy resource backing, market recognition of their ESG information disclosure is relatively low, so that the information asymmetry implied by rating divergence is more likely to trigger cognitive bias among investors. When ESG rating divergence widens, non-state-owned enterprises face escalating information verification costs, and investors struggle to effectively reconcile heterogeneous rating information. This aggravates expected divergence and ultimately manifests in significant stock price crash risk accumulation. In contrast, state-owned enterprises have formed a unique social responsibility governance paradigm under multiple institutional constraints: based on the public responsibility requirements in the principal-agent relationship, they have generally established ESG management systems aligned with their policy objectives, and made higher strategic inputs in three areas—enhancing the degree of participation in social governance, improving the stakeholder communication mechanism, and strengthening the construction of the reputational risk prevention and control system. This systemic advantage enables the information shock of ESG rating divergence in state-owned enterprises to be effectively buffered by internal governance mechanisms, thus avoiding excessive perturbation of market expectations caused by single-dimensional rating differences. At the same time, state-owned enterprises' policy compliance orientation and social capital integration capabilities enable them to maintain investor confidence in the face of ESG rating divergence through institutional explanatory channels, thereby inhibiting irrational risk aggregation.

5.2.2. Heterogeneity Test Based on the Level of Marketization

To examine if varying marketization levels affect the above effect differently, this paper draws on Fan Gang et al.'s China Provincial Marketization Index Report, splits sample firms into high/low marketization groups by annual marketization index median, then re-runs regressions. Table 10 results indicate that in low-marketization samples, ESG rating

divergence exerts a significantly positive effect on coefficients at least at the 5% level, and are larger than those in high-marketization groups.

Table 10. Heterogeneity analysis (marketization level).

	(1)	(2)	(3)	(4)
	High-Marketization	Low-Marketization	High-Marketization	Low-Marketization
	NCSKEW	NCSKEW	DUVOL	DUVOL
L.ESGdif6	0.018	0.025 **	0.012 *	0.035 ***
	(1.55)	(2.29)	(−1.78)	(4.31)
Size	−0.045 ***	−0.038 ***	0.025 ***	−0.034 ***
	(−4.70)	(−4.79)	(−4.70)	(−6.36)
Lev	0.141 **	0.126 **	−0.011	0.131 ***
	(2.48)	(2.53)	(−0.35)	(3.98)
ROA	−0.039	0.443 ***	−0.193 **	0.217 **
	(−0.26)	(3.25)	(−2.35)	(2.42)
Board	−0.126 ***	−0.054	−0.015	−0.043
	(−2.77)	(−1.36)	(−0.61)	(−1.63)
Balance1	0.100 ***	0.035	0.011	0.026
	(3.34)	(1.30)	(0.66)	(1.43)
Big4	0.008	−0.020	−0.010	−0.018
	(0.24)	(−0.64)	(−0.51)	(−0.89)
Ret	−13.819 ***	−16.057 ***	−5.220 ***	−11.364 ***
	(−11.09)	(−13.68)	(−8.37)	(−14.72)
Sigma	−7.305 ***	−6.941 ***	−2.701 ***	−4.271 ***
	(−15.40)	(−16.07)	(−11.51)	(−15.03)
INST	0.134 ***	0.073 *	0.047 **	0.056 **
	(3.34)	(1.92)	(2.19)	(2.22)
Growth	0.120 ***	0.091 ***	0.030 **	0.046 ***
	(4.95)	(4.23)	(2.44)	(3.26)
_cons	1.200 ***	0.929 ***	0.579 ***	0.782 ***
	(5.70)	(5.12)	(4.97)	(6.55)
N	12,753	12,935	12,753	12,935
IND	YES	YES	YES	YES
YEAR	YES	YES	YES	YES
p-value	0.000		0.004	
R-Squared	0.080	0.091	0.058	0.091

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

The formation mechanism of this differentiation effect can be analyzed from two dimensions: the institutional environment and the behavioral characteristics of market participants—in a low-marketization institutional environment, the imperfections of the market mechanism and the lack of transparency in information disclosure make it difficult for the heterogeneous information implied by ESG rating divergence to be effectively integrated. When ESG rating divergences widen, investors have difficulty screening signals through complex information intermediation systems, which in turn exacerbates the risk of adverse selection. This risk ultimately manifests in a significant increase stock price crash risk. In contrast, regions with a higher degree of marketization present a double buffer mechanism: first, the maturity of the investor structure is higher, and professional institutional investors account for a higher proportion, with their stronger information analysis and processing ability effectively mitigating the impact of ESG single-dimension divergence; second, the completeness of the policy and regulatory system and system implementation effectiveness form an institutional buffer. The strict information disclosure system and ESG regulatory framework, which can regulate corporate behavior and guide market expectations, thus weaken the direct impact of ESG rating divergence on stock price crash risk. The synergy between the market mechanism and the regulatory framework in this institutional environment allows the negative effects of ESG heterogeneous information to be systematically diluted, thereby avoiding irrational amplification of risk.

5.2.3. Heterogeneity Test Based on Industry Pollution Level

Following prior studies (Guo et al., 2019) we split the full sample into heavily polluting and non-heavily polluting industries. As shown in Table 11, regarding industry pollution level, the heavily polluting group's coefficient is significantly positive at 5%, indicating that they are more sensitive to ESG rating divergence. This paper argues that heavily polluting

industries face stricter regulation and higher public concern, and thus ESG performance directly affects their survival and development. In this scenario, ESG rating divergence shakes the foundation of stakeholder trust and amplifies regulatory risk expectations (Ioannou & Serafeim, 2015). In contrast, the coefficients for non-heavily polluting industries are significantly positive at the 10% statistical level, and all of them are lower than those for heavily polluting industries.

Table 11. Heterogeneity analysis (degree of industry contamination).

	(1)	(2)	(3)	(4)
	Heavily Polluting Industries	**Non-Heavily Polluting Industries**	**Heavily Polluting Industries**	**Non-Heavily Polluting Industries**
	NCSKEW	**NCSKEW**	**DUVOL**	**DUVOL**
L.ESGdif6	0.044 **	0.030 *	0.023 **	0.020 *
	(2.45)	(1.90)	(1.97)	(1.93)
Size	−0.050 ***	−0.052 ***	−0.039 ***	−0.041 ***
	(−4.05)	(−4.17)	(−4.74)	(−5.00)
Lev	0.119	0.170 **	0.088 *	0.137 ***
	(1.53)	(2.15)	(1.73)	(2.63)
ROA	0.629 ***	0.168	0.211	0.062
	(2.65)	(0.77)	(1.36)	(0.43)
Board	−0.130 **	−0.050	−0.076 **	−0.061
	(−2.22)	(−0.80)	(−1.98)	(−1.47)
Balance1	0.062	0.116 ***	0.044 *	0.067 **
	(1.56)	(2.77)	(1.70)	(2.43)
Big4	−0.097 **	0.072	−0.083 ***	0.049 *
	(−2.40)	(1.62)	(−3.16)	(1.66)
Ret	−15.871 ***	−12.383 ***	−11.445 ***	−8.977 ***
	(−7.92)	(−7.32)	(−8.71)	(−8.09)
Sigma	−7.795 ***	−6.890 ***	−4.912 ***	−4.425 ***
	(−11.39)	(−10.62)	(−10.96)	(−10.40)
INST	0.135 **	0.040	0.102**	0.043
	(2.23)	(0.70)	(2.57)	(1.14)
Growth	0.084 **	0.157 ***	0.048 **	0.092 ***
	(2.54)	(5.11)	(2.22)	(4.56)
_cons	1.353 ***	1.166 ***	0.990 ***	0.961 ***
	(4.85)	(4.26)	(5.41)	(5.35)
N	18,502	7186	18,502	7186
IND	YES	YES	YES	YES
YEAR	YES	YES	YES	YES
p-value	0.000		0.003	
R-Squared	0.094	0.076	0.098	0.080

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

This difference can be explained by two dimensions: industry attributes and investor decision logic. From the perspective of industry attributes, non-heavily polluting industries are generally less environmentally destructive and mostly dominated by service-oriented businesses, whose core value creation process is less sensitive to ESG risks. According to legitimacy theory, such industries are less environmentally harmful and face relatively limited social compliance pressures and reputational risk premium effects, leading to a natural dampening of the shock transmission mechanism of ESG rating divergences on stock prices. In terms of investor behavioral logic, established studies have shown that ESG issues in non-heavily polluting industries are less substantively correlated with firms' financial performance (Ioannou & Serafeim, 2015), which makes it possible that investors may be more inclined to rely on traditional financial metrics rather than ESG information in their decision-making process.

5.3. Dimensionality Test

ESG ratings are evaluated across environmental, social and corporate governance dimensions. While prior empirical studies show that ESG rating divergence worsens stock price crash risk, whether effects differ across dimensions remains unexamined. Table 12 shows that ESG rating divergence coefficients on environmental, social and corporate governance dimensions are significantly positive at least at the 10% level, indicating that each such divergence affects stock price crash risk positively significantly.

Table 12. Dimensionality test.

	(1)	(2)	(3)	(4)	(5)	(6)
	Environmental		Social		Corporate Governance	
	NCSKEW	DUVOL	NCSKEW	DUVOL	NCSKEW	DUVOL
L.ESGdif6	0.056 **	0.026 *	0.035 ***	0.017 ***	0.060 **	0.051 ***
	(2.40)	(1.90)	(3.04)	(2.64)	(2.09)	(2.66)
Size	−0.036 *	−0.034 ***	−0.034 ***	−0.034 ***	−0.043 **	−0.040 ***
	(−1.89)	(−3.11)	(−3.69)	(−6.64)	(−2.07)	(−2.83)
Lev	0.107	0.119*	0.060	0.128 ***	−0.024	0.143
	(0.94)	(1.82)	(1.01)	(4.02)	(−0.18)	(1.63)
ROA	0.712 **	0.407 **	0.203	0.099	0.402	0.330
	(2.30)	(2.20)	(1.33)	(1.16)	(1.05)	(1.29)
Board	−0.129	−0.109 **	−0.071	−0.042 *	−0.044	−0.071
	(−1.49)	(−2.16)	(−1.58)	(−1.70)	(−0.43)	(−1.04)
Balance1	0.041	−0.009	0.106 ***	0.057 ***	0.056	0.038
	(0.71)	(−0.27)	(3.51)	(3.42)	(0.84)	(0.84)
Big4	−0.028	−0.038	−0.008	−0.010	0.059	0.022
	(−0.38)	(−0.87)	(−0.24)	(−0.54)	(0.61)	(0.34)
Ret	−18.109 ***	−11.330 ***	−18.891 ***	−10.404 ***	−15.903 ***	−11.295 ***
	(−7.73)	(−7.81)	(−15.28)	(−14.77)	(−5.65)	(−5.99)
Sigma	−7.266 ***	−4.519 ***	−6.241 ***	−4.952 ***	−6.878 ***	−4.177 ***
	(−7.82)	(−8.09)	(−12.95)	(−18.51)	(−6.30)	(−5.71)
INST	−0.057	0.024	0.081*	0.062 ***	0.051	0.062
	(−0.68)	(0.50)	(1.90)	(2.72)	(0.52)	(0.94)
Growth	0.113 **	0.049 *	0.148 ***	0.065 ***	0.127 **	0.047
	(2.15)	(1.74)	(5.99)	(4.73)	(2.49)	(1.36)
_cons	1.128 ***	0.956 ***	0.860 ***	0.805 ***	1.062 **	0.946 ***
	(2.67)	(3.97)	(4.13)	(7.04)	(2.32)	(3.08)
N	25,688	25,688	25,688	25,688	25,688	25,688
IND	YES	YES	YES	YES	YES	YES
YEAR	YES	YES	YES	YES	YES	YES
R-Squared	0.118	0.097	0.096	0.092	0.107	0.102
F	21.461	22.504	65.582	85.901	13.826	12.972

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.).

6. Conclusions

Using 2015–2022 Shanghai–Shenzhen A-share listed firm data, this study empirically tests ESG rating divergence's impact and mechanism on stock price crash risk, and conducts heterogeneity analysis across three dimensions: property rights nature, marketization level, and industry pollution degree. This study finds that ESG rating divergence has a significant positive effect on stock price crash risk. Mechanism tests suggest that ESG rating divergence exacerbates stock price crash risk through two paths: first, it raises the risk of damage to corporate reputation and erodes investor trust; second, it reduces the attention of external monitoring and condones management's opportunistic behavior, which ultimately leads to deeper information asymmetry and risk accumulation. Heterogeneity results show that ESG rating divergence's effect on stock price crash risk is more pronounced among non-state-owned firms, low-marketability firms, and high-pollution industry firms.

The findings of this study are instructive for investors, companies and governments. First, investors should strengthen ESG information screening capabilities and pay attention to the heterogeneity of the institutional environment. Investors need to be alert to the risk of information asymmetry behind ESG rating divergences, avoid relying on the conclusions of a single rating agency, and combine the nature of corporate property rights, the level of marketization, industry pollution degree, and other factors in the institutional environment to comprehensively judge the actual impact of rating divergences. For non-state-owned enterprises, enterprises with a low level of marketization, and enterprises belonging to heavily polluting industries, it is necessary to focus on assessing the quality and credibility of their ESG disclosure, and to be vigilant against the amplification effect of expectations divergence caused by rating divergence. Second, enterprises should optimize ESG information disclosure and build a differentiated risk prevention and control system. Enterprises should take the initiative to improve the ESG information disclosure mechanism to reduce information asymmetry. In response to ESG rating differences, enterprises can establish a cross-agency rating-comparison analysis framework, identify the core areas of differences in a timely manner and disclose explanations to reduce investor cognitive bias. At the

same time, internal governance and external supervision should be strengthened to curb management's "greenwashing" behavior, so as to reduce the endogenous causes of rating disagreements. Third, the government and regulators should improve the institutional environment to guide the standardized development of ESG investment. To address the issue of ESG rating divergence caused by inconsistent agency standards, regulators should take the lead in establishing a unified ESG information disclosure framework and rating methodology to reduce the cost of information processing for market participants. Regulators should encourage third-party agencies to strengthen data sharing and rating logic transparency to reduce rating disagreements due to standard heterogeneity. At the same time, regulators should enhance the proportion of institutional investors through policy guidance, cultivate a mature market investment culture, and enhance the market's ability to integrate and digest ESG heterogeneous information. Meanwhile, regulators and financial institutions should popularize ESG investment knowledge through online and offline channels to enhance investors' understanding of ESG rating logic and causes of divergence, and strengthen their independent analysis and risk identification capabilities to avoid blindly following rating conclusions. In addition, governments and regulatory agencies can also require the media to strengthen its external supervisory role by providing subsidies and incentive mechanisms to encourage the media to follow up on companies with significant rating discrepancies, thereby filling the external supervision gap. An ESG rating divergence warning mechanism can also be established. When there is significant divergence, companies and rating agencies are required to jointly explain the reasons for the divergence to protect the rights and interests of stakeholders.

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Appendix A

Table A1. GMM model.

	(1)	(2)
	NCSKEW	**DUVOL**
L.NCSKEW	0.037 **	
	(1.97)	
L.DUVOL		0.051 **
		(2.30)
L.ESGdif6	0.406 ***	0.246 ***
	(3.74)	(3.33)
Size	−0.153	0.042
	(−0.64)	(0.33)
Lev	0.057	−1.436
	(0.02)	(−1.00)
ROA	−2.565	−3.677 **
	(−0.92)	(−2.21)

Table A1. *Cont.*

	(1)	(2)
	NCSKEW	**DUVOL**
Board	0.570	0.063
	(0.36)	(0.05)
Balance1	−2.452	−2.471 **
	(−1.56)	(−2.13)
Big4	0.149	−0.509
	(0.06)	(−0.33)
Ret	−32.457 ***	−17.773 ***
	(−6.96)	(−5.33)
Sigma	−5.012	−5.954 *
	(−1.07)	(−1.88)
INST	0.200	0.009
	(0.11)	(0.01)
Growth	1.614 ***	1.307 ***
	(5.73)	(6.87)
_cons	2.514	0.390
	(0.51)	(0.16)
N	15,052	15,052
IND	YES	YES
YEAR	YES	YES
R-Squared	0.0147	0.0119

(Significance levels are denoted as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.)

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